THE MOON AS A THANATOCOENOSIS: IS THERE ANY HOPE FOR LUNAR PALEONTOLOGY? P.J. Boston[1] and G.K. Schmidt[2], [1]NASA Astrobiology Institute (NAI) penelope.j.boston@nasa.gov, and [2]Solar System Exploration Virtual Institute gregory.schmidt@nasa.gov, NASA Ames Research Center, Moffett Field, CA 94035.

Introduction: The definition of a thanatocoenosis is an assemblage of fossil materials that exists in a particular deposit because they were transported there by some natural process, e.g. a river, a predator, wind… The dominant characteristic of such assemblages is that they are a mixture of species that mostly did not live together in life but found themselves with new fossil friends post-mortem. In the case of possible biosignature-containing Earth ejecta that may have made its way to the Moon, the transport mechanism is the dramatic result of major impacts taking place on Earth and potentially gifting the Moon with such materials. This idea has been advanced before [1,2,3] but in light of a potentially imminent enhanced cadence of lunar exploration opportunities as we approach the second quarter of the 21st Century, it is time to make a concerted assessment of the potential practical ways in which such searches for fossil/biogeochemical/mineralogical evidence from Earth's biosphere might be found.

Scientific Advances: Over the past decade or so, significant plausibility experiments have been conducted to test the survivability of organics and microorganisms to various environmental challenges that would beset transfer of biologically significant materials from Earth to the Moon [e.g. 4, 5]. Very recently, the claim of an Earth-derived Apollo sample has been made [6]. If true, this lends credence to the notion that early Earth materials of significance to origins of life on Earth and astrobiology in general may be found on the moon.

Analysis: We present a comprehensive review of relevant lunar science in combination with the latest understanding of organic and organismic survivability to predict where and how such materials can be sought on the moon during a future era of significant lunar exploration activity.

References: [1] Armstrong et al. 2002. Icarus 160:183–196. [2] Crawford, 2006. Int'l J Astrobiol 5:191-197. [3] Crawford et al 2008. Astrobiol. 8(2):242-252. [4] Burchell et al. 2010. Earth Moon Planets 107:55–64. [5] Parnell et al. 2010. Meteoritics & Planet Sci 45(8):1340–1358. [6] Bellucci et al. 2019. Earth Planet Sci Lett 510:173-185.